

Test for multiple impactors in Apollo 17 impact melt rocks

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Motivation

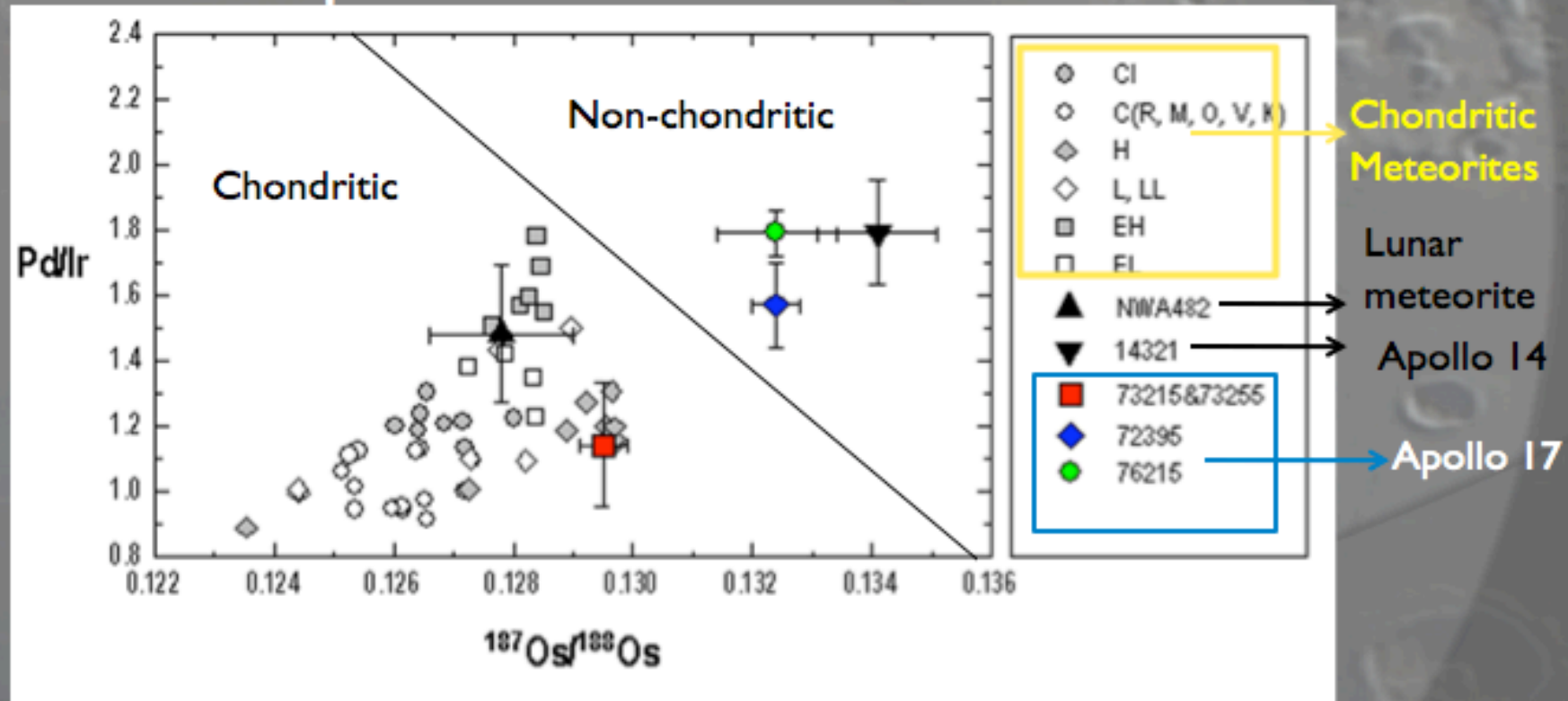
- Moon should record the same impactor population as early Earth
- Chondritic meteorites contain important biogenic materials

Sulfur, Carbon,
Water

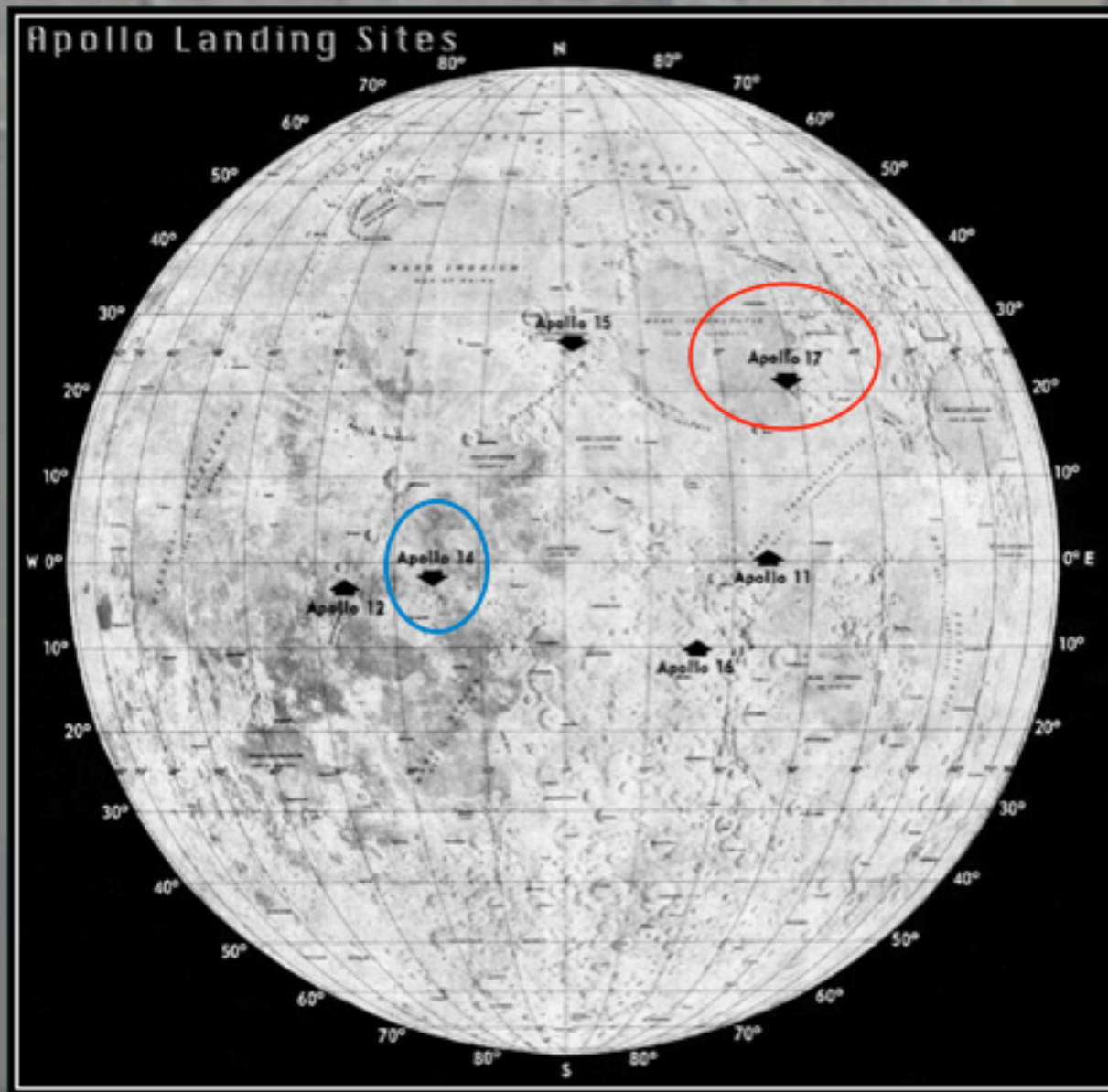


Motivation

- Previous studies have identified at least two distinct impactor signatures in Apollo 17 impact melt rocks



Location of Sampling Sites

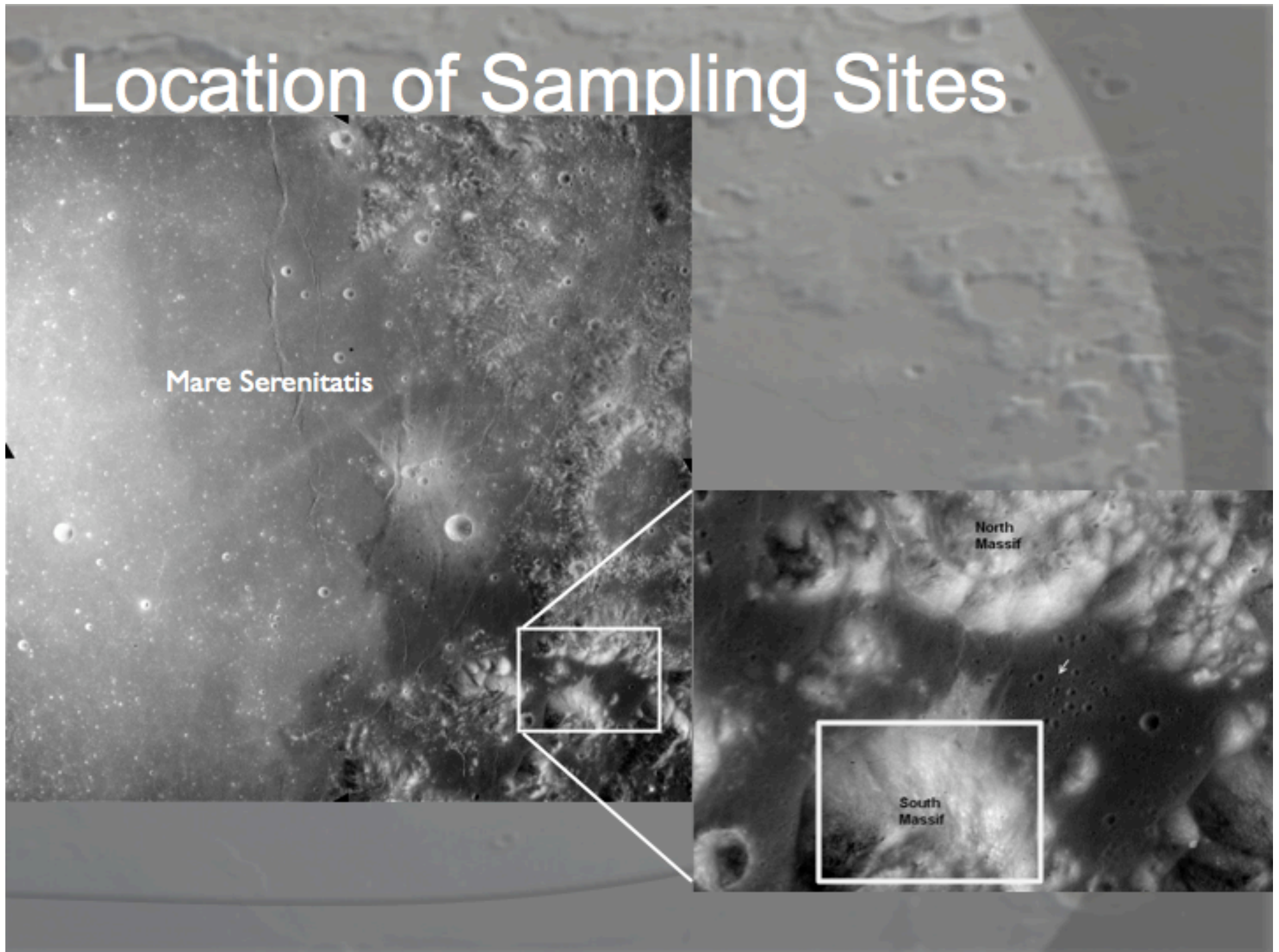


Location of Sampling Sites

Mare Serenitatis

North
Massif

South
Massif



Overview of Highly Siderophile Elements

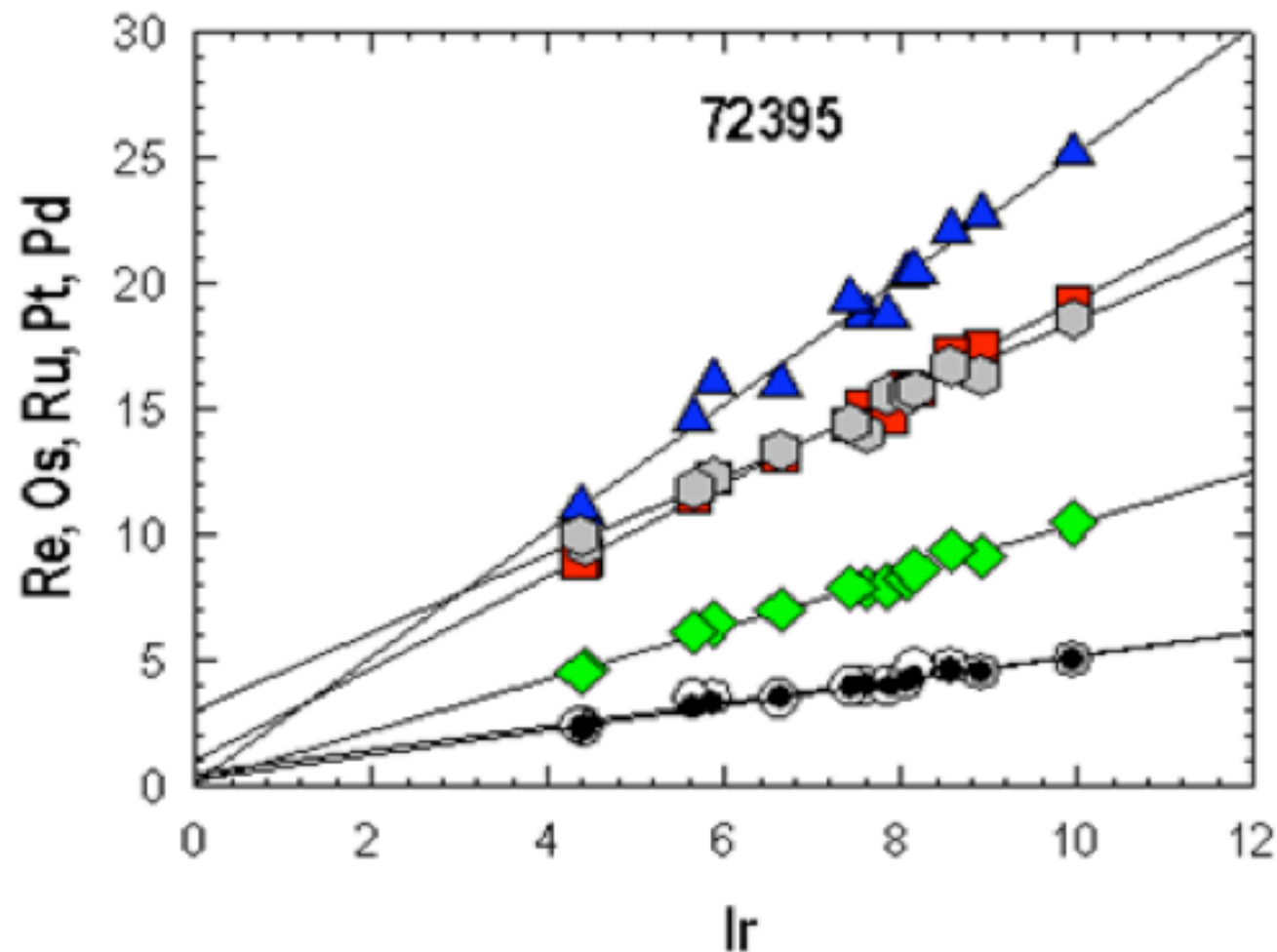
- Re, Os, Ir, Ru, Pt, Pd. Strong tendency to partition into metal relative to silicates
- $^{187}\text{Os}/^{188}\text{Os}$ is a proxy for long-term Re/Os
- Refractory (non-volatile)
- Very low abundance in lunar crust
- High abundance in likely impactors

Hypothesis

- If more than one distinct chemical signature of the impactor is observed in our data, then three possible explanations arise:

- 1) It may be an indicator of an impact event other than the main Serenitatis impact
- 2) Some of the highly siderophile elements might have volatilized on impact
- 3)Serenitatis impactor was not homogeneous
- 4)A combination of two or more possibilities

Relative elemental abundances (parts per billion)

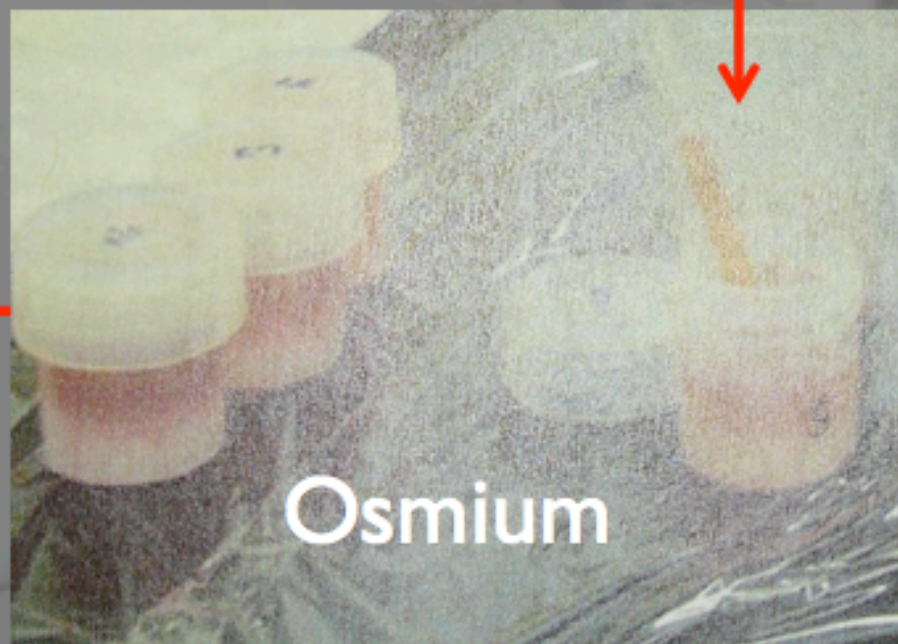
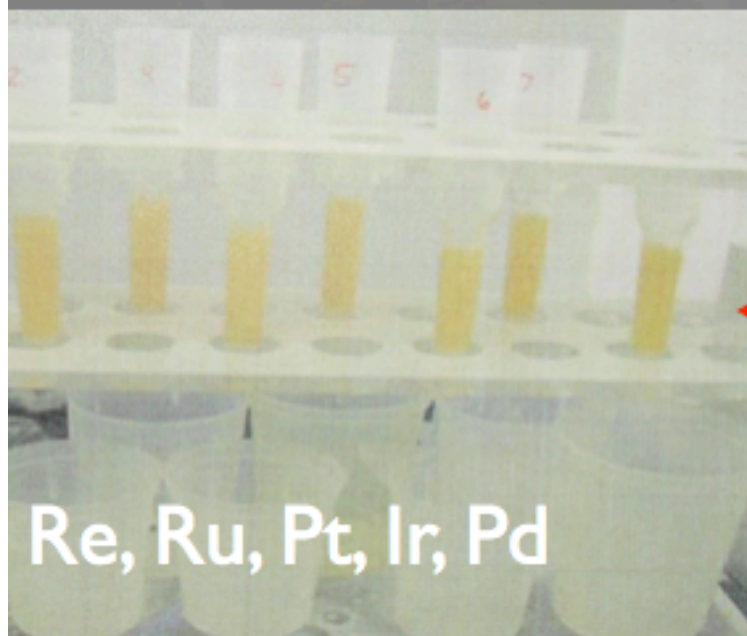
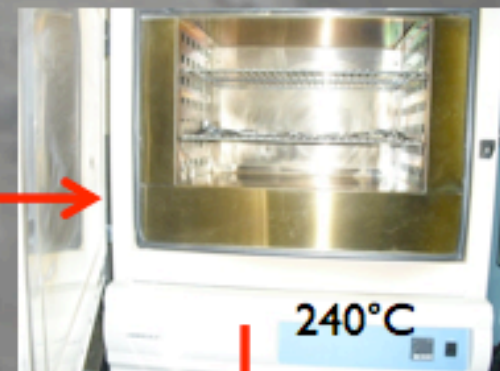


'Fingerprint' of the impactor

Slopes define elemental ratio of the impactor

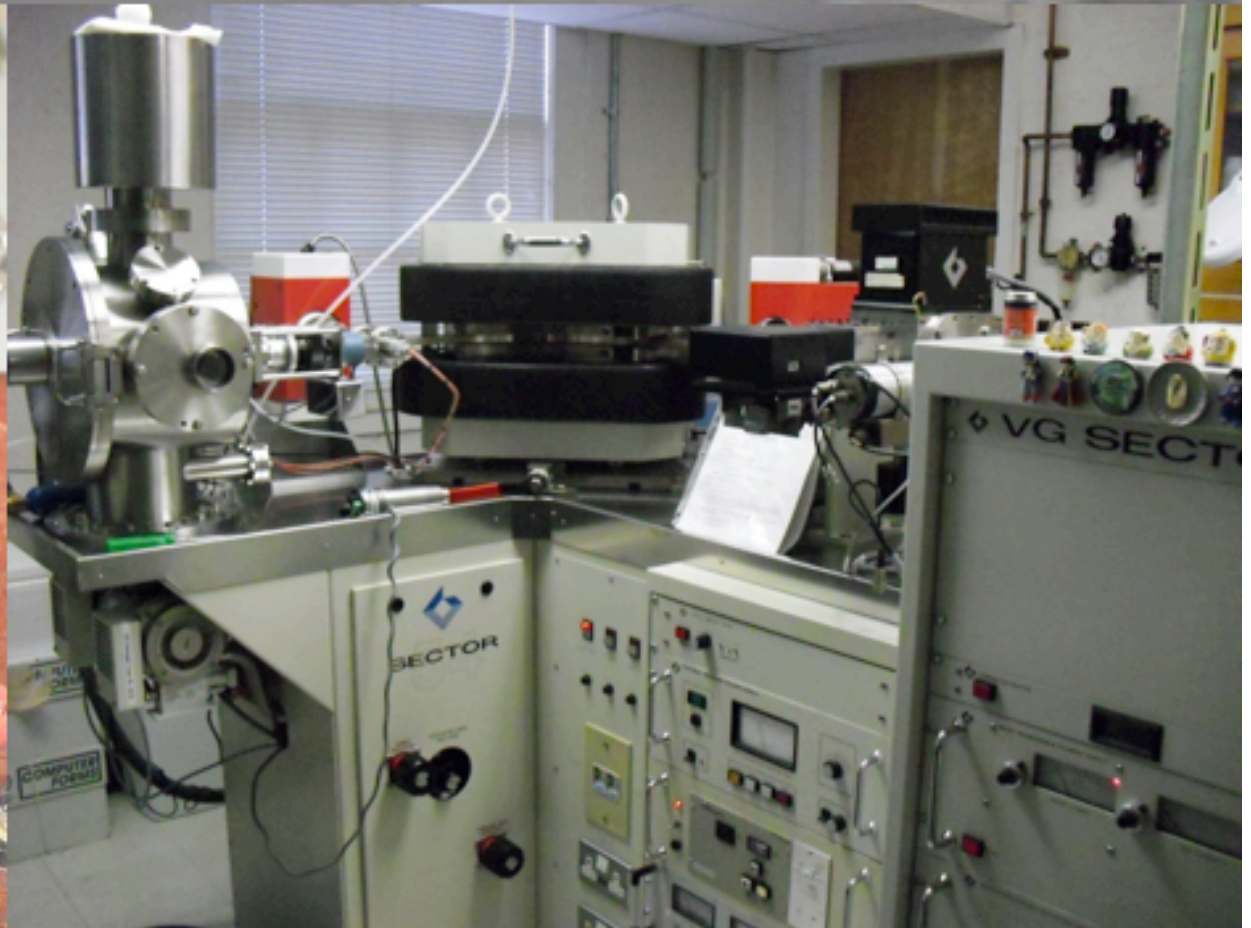
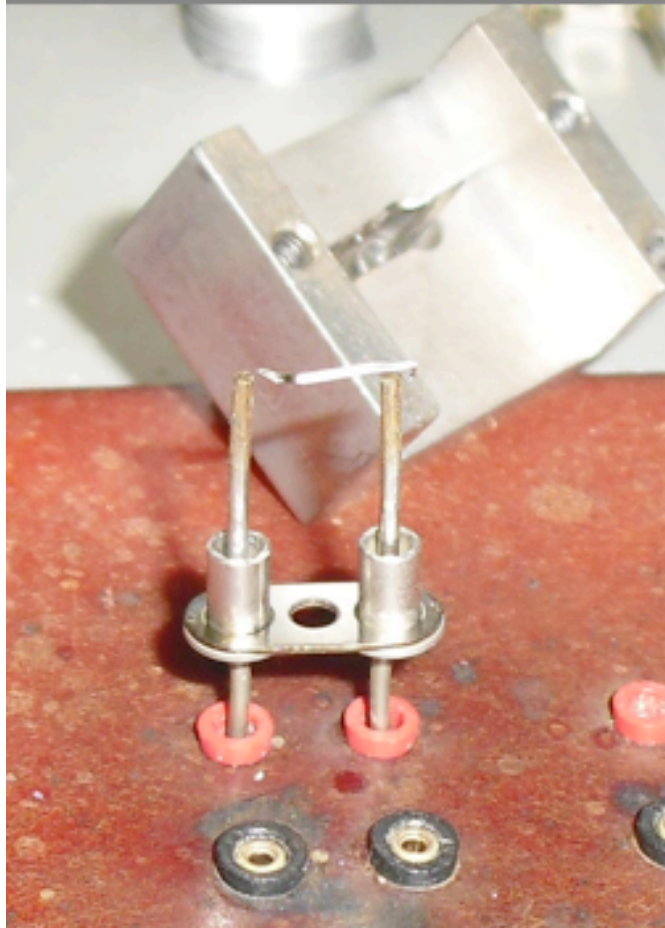
Methods

■ Chemical separation



Methods (Osmium)

- Isotopic analysis using Thermal Ionization Mass Spectrometer

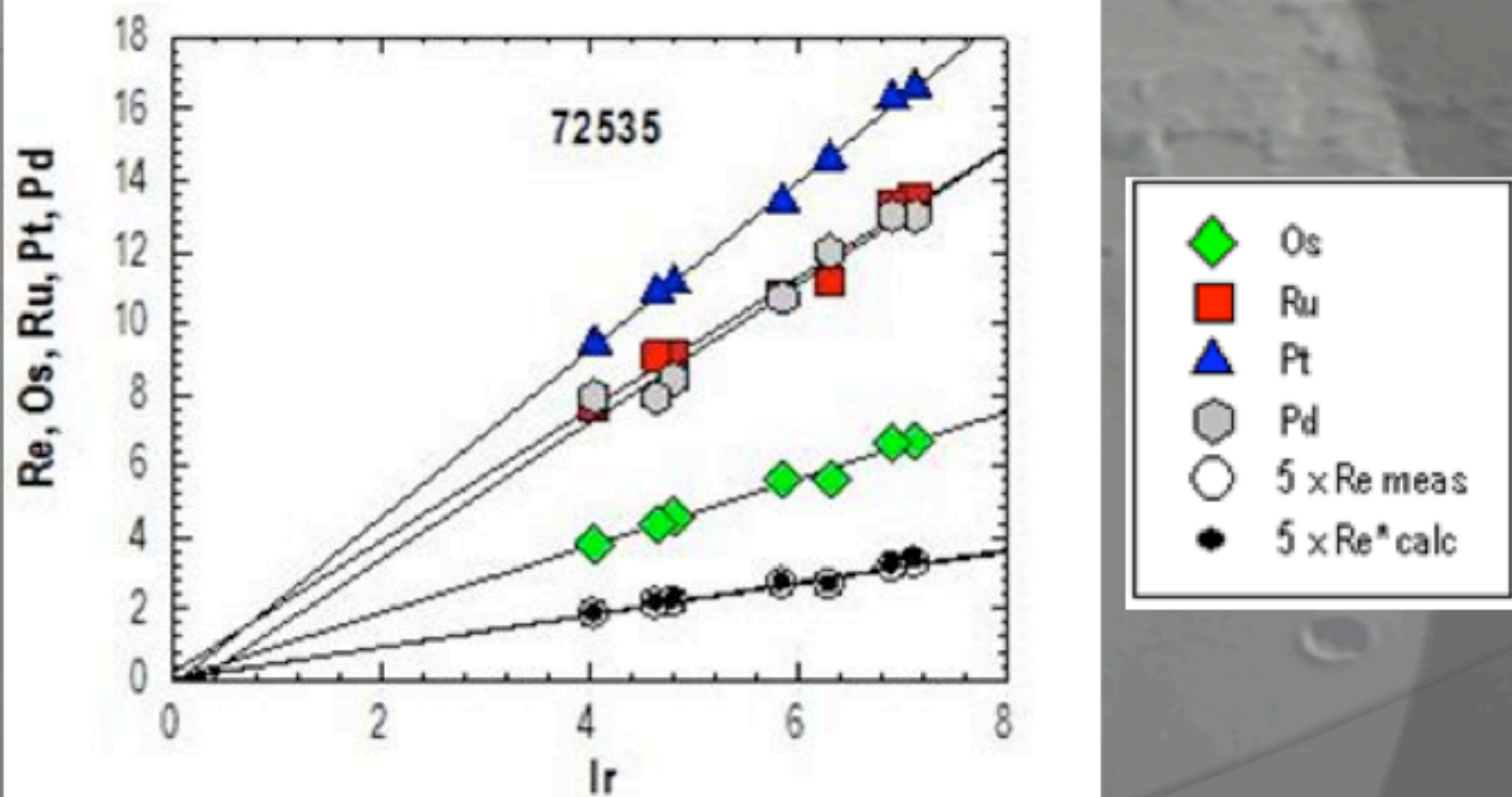


Methods (Re, Ru, Pt, Ir, Pd)

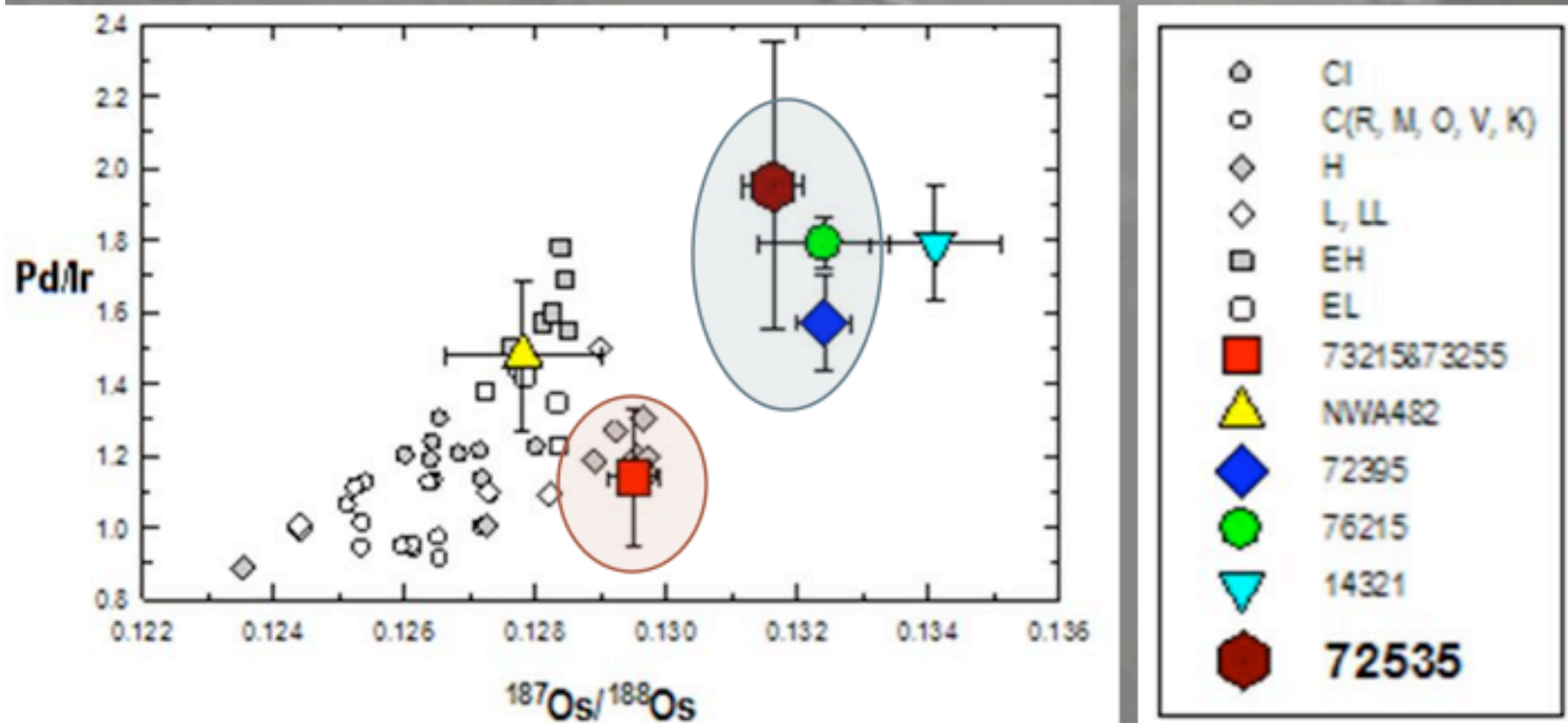
- Isotopic analysis using Inductively Coupled Plasma Mass Spectrometer



Results



Results



Conclusions

- Well-behaved sample
- Modest concentration range
- All elements show good linear trends
- Slopes of all elements overlap with slopes of polykilitic melt breccias

Question:

- What is the meaning of non-chondritic elemental ratios observed in our data?

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